

Claims

1. A continuous method for coating optical lenses comprising the steps of:
  - (a) providing a leading first empty carriage and preceding second empty carriage, each carriage adapted to hold a plurality of jigs containing lenses in a front-back and side-by-side arrangement, each jig adapted to hold a single lens;
  - (b) providing a plurality of preceding carriages each of which is filled with a plurality of jigs in a front-back and side-by-side arrangement, forming a filled jig carriage;
  - (c) providing an uncoated lens loading station including an uncoated lens loading arm, a lens supply, a coated lens unloading station, a coating tank, coated lens unloading arm and a coated lens removal system;
  - (d) positioning the filled jig carriage at the uncoated lens loading arm;
  - (e) removing the front side-by-side row of jigs from the filled jig carriage onto the uncoated lens loading arm;
  - (f) securing a lens from the lens supply in each jig in the uncoated lens loading arm forming a plurality of lens containing jigs;
  - (g) moving the filled jig carriage back with the second empty carriage so that the second empty carriage is in a position adjacent the uncoated lens loading arm and transferring each lens containing jig to the second empty carriage;
  - (h) repeating steps (d)-(g) until the filled jig carriage now is empty forming an empty carriage and the second empty carriage is full forming a filled jig and uncoated lens carriage;
  - (i) removing the filled jig and uncoated lens carriage from the uncoated lens loading station;
  - (j) coating the lenses in the filled jig and uncoated lens carriage in the coating tank forming a filled jig and coated lens carriage;

- (k) moving the leading first empty carriage and filled jig and coated lens carriage to the coated lens unloading station;
- (l) positioning the filled jig and coated lens carriage at the coated lens unloading arm;
- (m) removing a front side-by-side row of jigs from the filled jig and coated lens carriage onto the coated lens unloading arm;
- (n) removing the coated lenses from the jigs onto the coated lens removal system and removing the coated lenses from the system;
- (o) moving the first empty carriage back with the filled jig and coated lens carriage so that the first empty carriage is positioned adjacent the coated lens unloading arm;
- (p) transferring the jigs from the coated lens unloading arm to the first empty carriage;
- (q) repeating steps (l)-(p) until the filled jig and coated lens carriage is empty forming an empty carriage and the first empty carriage is full forming a filled jig carriage;
- (r) removing the filled jig carriage from the coated lens unloading section and repeating steps (l)-(p) to unload lenses from another filled jig and coated lens carriage; and
- (s) repeating the above steps until all the lenses are coated.

2. The method of claim 1 wherein the carriages are configured to hold 6 or more jigs side-by-side and 6 or more jigs in a front-back arrangement.

3. The method of claim 1 wherein the uncoated lens loading arm and the coated lens unloading arm move in a 90° arc from a vertical position to a horizontal position.

4. A method for coating optical lenses comprising the steps of:

- 2 (a) providing a leading first empty carriage, the carriage adapted to hold a
- 3 plurality of jigs containing lenses in a front-back and side-by-side
- 4 arrangement, each jig adapted to hold a single lens;
- 5 (b) providing a plurality of preceding carriages each of which is filled with a
- 6 plurality of jigs in a front-back and side-by-side arrangement, forming a filled
- 7 jig carriage;
- 8 (c) providing an uncoated lens loading station including an uncoated lens
- 9 loading arm, a lens supply, a coated lens unloading station, a coating tank,
- 10 coated lens unloading arm and a coated lens removal system;
- 11 (d) positioning the filled jig carriage at the uncoated lens loading arm;
- 12 (e) removing the front row of jigs from the filled jig carriage onto the uncoated
- 13 lens loading arm;
- 14 (f) securing a lens from the lens supply in each jig in the uncoated lens loading
- 15 arm forming a plurality of lens containing jigs;
- 16 (g) moving the filled jig carriage back so that the first empty carriage is in a
- 17 position adjacent the uncoated lens loading arm and transferring each lens
- 18 containing jig to the second empty carriage;
- 19 (h) repeating steps (d)-(g) until the filled jig carriage now is empty forming an
- 20 empty carriage and the second empty carriage is full forming a filled jig and
- 21 uncoated lens carriage;
- 22 (i) removing the filled jig and uncoated lens carriage from the uncoated lens
- 23 loading station;
- 24 (j) coating the lenses in the filled jig and uncoated lens carriage in the coating
- 25 tank forming a filled jig and coated lens carriage;
- 26 (k) moving a leading second empty carriage and filled jig and coated lens
- 27 carriage to the coated lens unloading station;
- 28 (l) positioning the filled jig and coated lens carriage at the coated lens
- 29 unloading arm;
- 30 (m) removing a front row of jigs from the filled jig and coated lens carriage onto
- 31 the coated lens unloading arm;

- 32 (n) removing the coated lenses from the jigs onto the coated lens removal  
33 system conveyor and removing the coated lenses from the system;  
34 (o) moving the second empty carriage back so that the second empty carriage is  
35 positioned adjacent the coated lens unloading arm;  
36 (p) transferring the jigs to the second empty carriage;  
37 (q) repeating steps (l)-(p) until the filled jig and coated lens carriage is empty  
38 forming an empty carriage and the second empty carriage is full forming a  
39 filled jig carriage;  
40 (r) removing the filled jig carriage from the coated lens unloading section and  
41 repeating steps (l)-(p) to unload lenses from another filled jig and coated lens  
42 carriage; and  
43 (s) repeating the above steps until all the lenses are coated.

1 5. The method of claim 4 wherein the carriages are configured to hold 6 or  
2 more jigs side-by-side and 6 or more front-back arrangement.

1 6. The method of claim 5 wherein the uncoated lens loading arm and the  
2 coated lens unloading arm move in a 90° arc from a vertical position to a  
3 horizontal position.

1 7. A method for coating optical lenses comprising the steps of:

- 2 (a) providing a leading first empty carriage, the carriage adapted to hold a  
3 plurality of jigs containing lenses in a front-back and side-by-side  
4 arrangement, each jig adapted to hold a single lens;  
5 (b) providing a plurality of preceding carriages each of which is filled with a  
6 plurality of jigs in a front-back and side-by-side arrangement, forming a filled  
7 jig carriage;  
8 (c) providing an uncoated lens loading station including an uncoated lens  
9 loading arm and a lens supply, and a coating tank;

- (d) positioning the filled jig carriage at the uncoated lens loading arm;
- (e) removing the front row of jigs from the filled jig carriage onto the uncoated lens loading arm;
- (f) securing a lens from the lens supply in each jig in the uncoated lens loading arm forming a plurality of lens containing jigs;
- (g) moving the filled jig carriage back so that the first empty carriage is in a position adjacent the uncoated lens loading arm and transferring each lens containing jig to the second empty carriage;
- (h) repeating steps (d)-(g) until the filled jig carriage now is empty forming an empty carriage and the second empty carriage is full forming a filled jig and uncoated lens carriage;
- (i) removing the filled jig and uncoated lens carriage from the uncoated lens loading station;
- (j) coating the lenses in the filled jig and uncoated lens carriage in the coating tank forming a filled jig and coated lens carriage; and
- (k) removing the coated lens.

8. A method for removing coated lens from a coating system comprising the steps of:

- (a) moving a leading empty carriage and a filled jig and coated lens carriage to a coated lens unloading station;
- (b) positioning the filled jig and coated lens carriage at a coated lens unloading arm;
- (c) removing a front row of jigs from the filled jig and coated lens carriage onto the coated lens unloading arm;
- (d) removing the coated lenses from the jigs onto a coated lens removal system and removing the coated lenses from the system;
- (e) moving the empty carriage back so that the empty carriage is positioned adjacent the coated lens unloading arm;

- 13 (f) transferring the jigs to the empty carriage;  
14 (g) repeating steps (b)-(f) until the filled jig and coated lens carriage is empty  
15 forming an empty carriage and the empty carriage is full forming a filled jig  
16 carriage;  
17 (h) removing the filled jig carriage from the coated lens unloading section and  
18 repeating steps (b)-(f) to unload lenses from another filled jig and coated lens  
19 carriage; and  
20 (i) repeating the above steps until all the coated lenses are removed from the  
21 system.

1 9. An apparatus for coating optical lenses comprising:

- 2 a filled jig carriage which contains jigs in a front-back and side-by-side  
3 configuration;  
4 an empty carriage;  
5 an uncoated lens loading station;  
6 an uncoated lens loading arm;  
7 an uncoated lens input means;  
8 a coating section;  
9 a coated lens unloading section;  
10 a coated lens unloading arm;  
11 a coated lens output means;

12 wherein a leading empty carriage and preceding filled jig carriage are  
13 positioned in the uncoated lens loading section with the filled jig carriage  
14 adjacent the uncoated lens loading arm wherein the uncoated lens loading  
15 arm removes a single front side-by-side row of jigs from the filled jig  
16 carriage, lenses from the uncoated lens input means are secured in the jigs  
17 and the filled jig carriage moved back so that the empty carriage is adjacent  
18 the uncoated lens loading arm and the lens containing jigs transferred to the  
19 empty carriage, with the above procedure being continued until the filled jig  
20 carriage is empty so that the empty carriage is now a filled jig and uncoated

21 lens carriage which is moved out of the uncoated lens loading section and is  
22 dipped in the coating section; and  
23 wherein after coating the lenses in the filled jig and uncoated lens carriage the  
24 carriage is now a filled jig and coated lens carriage and is moved into the  
25 coated lens unloading section with a leading empty carriage, the filled jig  
26 and coated carriage is moved adjacent the coated lens unloading arm and a  
27 single front side-by-side row of jigs and coated lenses removed from the  
28 carriage with the lenses being removed from the jigs and removed from the  
29 system using the coated lens output means, the filled jig and coated lens  
30 carriage is then being moved back so that the empty carriage is adjacent the  
31 coated lens unloading arm and the jigs transferred onto the empty carriage  
32 from the coated lens unloading arm with the above procedure being  
33 continued until the filled jig and coated lens carriage is empty so that the  
34 empty carriage is now a filled jig carriage and is moved out of the coated  
35 lens unloading section and is ready to be used in the uncoated lens loading  
36 section.

1 10. An apparatus for coating optical lenses comprising:

2 a filled jig carriage which contains jigs in a front-back and side-by-side  
3 configuration;  
4 an empty carriage;  
5 an uncoated lens loading station;  
6 an uncoated lens loading arm;  
7 an uncoated lens input means;  
8 a coating section; and

9 wherein a leading empty carriage and preceding filled jig carriage are  
10 positioned in the uncoated lens loading section with the filled jig carriage  
11 adjacent the uncoated lens loading arm wherein the uncoated lens loading  
12 arm removes a single front side-by-side row of jigs from the filled jig  
13 carriage, lenses from the lens input means are secured in the jigs and the

filled jig carriage moved back so that the empty carriage is adjacent the uncoated lens loading arm and the lens containing jigs transferred to the empty carriage, with the above procedure being continued until the filled jig carriage is empty so that the empty carriage is now a filled jig and uncoated lens carriage which is moved out of the uncoated lens loading section and is dipped in the coating section.

11. An apparatus for coating optical lenses comprising:

- a filled jig and coated lens carriage which contains jigs and coated lenses in a front-back and side-by-side configuration;
- an empty carriage;
- a coated lens unloading section;
- a coated lens unloading arm;
- a coated lens output means; and

wherein the filled jig and coated lens carriage is moved into the coated lens unloading section with a leading empty carriage, the filled jig and coated carriage is moved adjacent the coated lens unloading arm and a single front side-by-side row of jigs and coated lenses removed from the carriage with the lenses being removed from the jigs and removed from the system using the coated lens output means, the filled jig and coated lens carriage is then being moved back so that the empty carriage is adjacent the coated lens unloading arm and the jigs transferred onto the empty carriage from the coated lens unloading arm with the above procedure being continued until the filled jig and coated lens carriage is empty so that the empty carriage is now a filled jig carriage and is moved out of the coated lens unloading section.